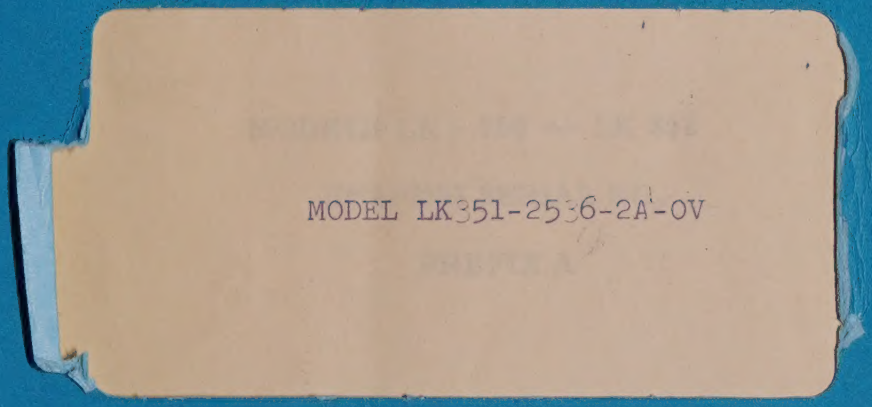
INSTRUCTION MANUAL

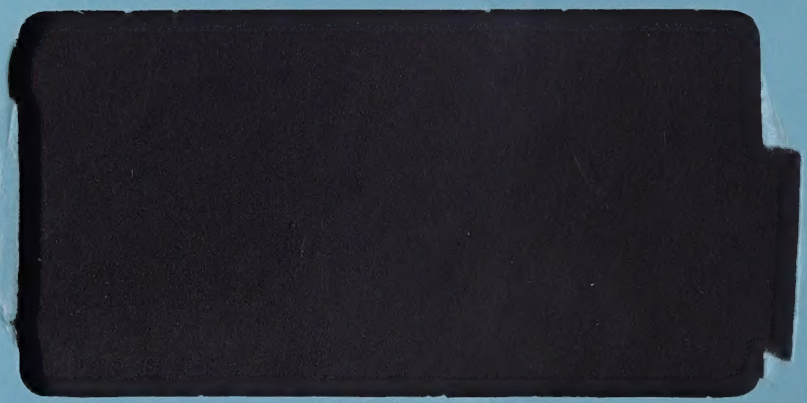
REGULATED POWER SUPPLIES



MP MASTER
MA28704

LAMBDA

LAMBDA ELECTRONICS CORP.–MELVILLE, L. I., N. Y.



MODEL LK351-2536-2A-OV

PRELIMINARY

INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

MODELS LK - 350 — LK 352

BEARING SERIAL NO.

PREFIX A

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics Corp. All information contained herein applies to all metered and non-metered LK full-rack models unless otherwise specified.

LAMBDA ELECTRONICS CORP. MELVILLE, L.I., N.Y.
MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

IM LK-FR

TABLE OF CONTENTS

Section		Page
SPECIFICATIONS AND FEATURES		1
OPERATING INSTRUCTIONS		4
	Controls, Instruments and Fuses	4
	Ground Connections	5
	Basic Modes of Operation	5
	Supply-Load Connections	5
	Detailed Operating Procedures	7
	Operation After Protective Device Shutdown	11
MAINTENANCE		11
	General	11
	Trouble Analysis	11
	Checking Transistors and Capacitors	11
	Painted Circuit Board Maintenance Techniques	12
	Adjustment of Calibration Controls	12
	Performance Checks	14
	Service and Parts Ordering	15

ADDENDA

MODEL LK 351-2536-2A-OV

The paragraphs of this instruction manual apply in general to the above model.

This modified unit differs from a standard unit in the following ways:

1. The AC input is 105-132 VAC or 188-228 VAC. The unit is wired for 105-132 VAC input. For reconnection to 188-228 VAC input, see Fig. I.

2. The DC output is 0-40V DC at 40A at 50°C.

3. The modified unit has provisions for remote current programming in the automatic crossover mode of operation.

4. A 2V drop in either of the power legs will not result in degradation of the power supply performance.

5. A specially screened front panel is mounted in place of the standard front panel.

6. The mounting flanges have been deleted from the modified unit.

SPECIFICATIONS AND FEATURES

The following specifications apply for all non-metered and metered LK full-rack models.

DC OUTPUT--Voltage regulated for line and load

Voltage Range .....

TABLE I
VOLTAGE RANGE

MODEL	350	351	352
VOLTAGE RANGE VDC	0-20	0-36	0-60

Multi-Current Ranges . . . . . Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range with input frequency 57-63 Hz. Derating for 50 Hz input frequency.

TABLE II

MODEL	CURRENT RANGE AT AMBIENT OF:			
	40°C	50°C	60°C	71°C
LK-350	0-35 A	0-31A	0-26A	0-20A
LK-351	0-25A	0-23A	0-20A	0-15A
LK-352	0-15A	0-14A	0-12.5A	0-10A

REGULATED VOLTAGE OUTPUT

Regulation (line) . . . . . 0.015 percent or 1.0 millivolt, whichever is greater for input variations from 105-132 or 132-105 volts AC

Regulation (load) . . . . . 0.015 percent or 1.0 millivolt, whichever is greater for load variations from 0 to full load or full load to 0

Remote Programming

External Resistor . . . . . Nominal 200 ohms/volt output

Programming Voltage . . . . . One-to-one voltage change

Ripple and Noise . . . . . 0.5 millivolts rms with either positive or negative terminal grounded

Temperature Coefficient . . . . . Change in output voltage less than 0.015%/^{o}C

DC OUTPUT--Current regulated for line and load; automatic crossover with voltage limit

Multi-Current Ranges . . . . . Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range. For maximum current range see Table II. Minimum current 5% of 40^{o} rating in Table II.

Voltage Range . . . . . For voltage range see Table I; voltage ratings apply for entire current range.

REGULATED CURRENT OUTPUT; AUTOMATIC CROSSOVER

Regulation (line) . . . . . Less than 10 milliamperes or 0.1%, whichever is greater, for input variations from 105-132 or 132-105 volts AC

Regulation (load) . . . . . Less than 10 milliamperes or 0.1%, whichever is greater, for load voltage changes from 0 to rated VDC or rated VDC to 0 volts.

AC INPUT--105-132 volts AC at 57-63 Hz

OVERLOAD PROTECTION

Thermal . . . . . Thermostat, resets automatically when over-temperature condition is eliminated

Electrical

External Overload Protection . . . . Adjustable, automatic, electronic current-limiting circuit, settable to 105 percent of rated current; limits output current to preset limit for protection of load and power supply when external overloads and short circuits occur

Internal . . . . . "SLO-BLO" 30A fuse F1 protects the AC input circuit. Overload of the supply does not cause fuse failure.

INPUT AND OUTPUT CONNECTIONS -- Heavy duty terminal block on rear of chassis with 5-foot, 3-wire detachable line cord for all models.

OVERSHOOT--No overshoot of output voltage under conditions of power turn-on, power turn-off, or power failure.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE--Continuous duty from $0^{\circ}C$ to $71^{\circ}C$ ambient with corresponding load current ratings for all modes of operation

STORAGE TEMPERATURE- (non-operating) $-55^{\circ}C$ to $+85^{\circ}C$

METERS-Voltmeter and ammeter on metered suffix (FM) models

CONTROLS

DC output controls	Coarse and fine voltage controls and coarse and fine current controls permit adjustment of DC output; located on front panel of all models
Remote Sensing	Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation
Power	Panel mounted circuit breaker and indicator light for all units.

PHYSICAL DATA

Size	5-1/4"H x 19"W x 16-1/2"D
Weight	95 lbs. net; 125 lbs. shipping wt.
Panel Finish	Brushed aluminum clear anodized panels with grey inlay (standard); special finishes available to customer's specifications at moderate surcharge.

MOUNTING:

Laboratory bench, table top	Bumpers secured to the base of all LK models permit proper circulation of air through the unit. Removal of bumpers will restrict free-flow of air through the unit, avoid removing bumpers.

Standard 19" rack mounting

MODEL OPTIONS

Suffix "OV" Overvoltage Protection Option. . All LK power supplies are available with a built-in overvoltage protection circuit which prevents damage to the load that can be caused by excessive power supply output voltage.

Suffix "R" Fungus Proofing Option . . .	Standard LK power supplies can be obtained with fungus proofing treatment with MIL V 173 varnish for all fungi nutrient components
Suffix "FM" Meter Option	Standard LK power supplies can be obtained with voltmeter and ammeter

OPERATING INSTRUCTIONS

CONTROLS, INSTRUMENTS AND FUSES

ON-OFF Circuit Breaker. The ON-OFF circuit breaker, located on the front panel, controls application of input power to the supply. When the switch is in the ON position, the red indicator glows.

OUTPUT VOLTAGE Control. The OUTPUT VOLTAGE control is a dual control consisting of a coarse adjustment potentiometer, which varies the DC voltage over a range 0-19, 0-35 or 0-59 volts, as applicable, and a fine adjustment potentiometer, which varies the DC voltage over a one-volt range. Clockwise rotation results in increasing voltage. The total DC voltage output for voltage regulated operation, is equal to the sum of each shaft setting; for current regulated operation the maximum voltage limit is equal to the sum of each shaft setting. The control is located on the front panel of all units.

CURRENT LIMITER Control. The CURRENT LIMITER control is a dual control consisting of a coarse adjustment potentiometer, which varies the DC current over 90% of the rated current range and a fine adjustment potentiometer, which varies the DC current over 10% of the rated current range. Clockwise rotation results in increasing current. The total DC current output for current regulated operation, is equal to the sum of each shaft setting; for voltage regulated operation the maximum current limit is equal to the sum of each shaft setting. The control is located on the front panel of all units.

Output Voltage Meter. A DC voltmeter monitors the voltage at the output terminals of metered (FM) units for the rated voltage range.

Output Current Meter. A DC ammeter monitors the load output current of metered (FM) units for the rated current range.

Fuses. Fuse F1, internally located, is a 30 ampere, 3AG "SLO-BLO" fuse which functions in the AC input circuit.

Connection Terminals. Make all connections to the supply at the terminal block on the rear of the supply. Apply input power through the line cord or directly to terminals 1 and 2 if the line cord is removed. Always connect the ungrounded (hot) power lead to terminal 1.

The supply positive terminal is brought out to terminal 6. The supply negative terminal is brought out to terminal 4. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 8. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the rear output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

OV ADJ Control. This potentiometer is only used on units with the OV Overvoltage Protector option. The OV ADJ control permits screwdriver setting of the overvoltage protection point through an access hole in the front panel.

GROUND CONNECTIONS

The Lambda power supply can be operated either with negative or positive output terminal grounded or with no terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

> NOTE: When operating the supply with neither terminal grounded, high impedance leakage resistance and capacitance paths can exist between the power supply circuitry and chassis ground.

BASIC MODES OF OPERATION

This power supply is designed to operate as a constant voltage source or as a constant current source. Automatic crossover to either mode of operation occurs when load conditions change as follows:

Constant Voltage. The power supply will function as a constant voltage source while the load current does not equal the current value, I_{LIM}, set by the CURRENT LIMITER control. When load current $I_L = \frac{V}{R_L} = I_{LIM}$, the supply will cross over automatically and will operate as a constant current source. Further decrease in value of load resistance R_L results in decrease of voltage across the load while current remains regulated to I_{LIM}.

Constant Current (Automatic Crossover). The power supply will function as a constant current source while the load voltage V_L does not equal the voltage value set by the OUTPUT VOLTAGE control. When load voltage V_L equals the value set by the OUTPUT VOLTAGE control, the supply will automatically cross over and operate as a constant voltage source.

SUPPLY-LOAD CONNECTIONS

> NOTE: Refer to DETAILED OPERATING PROCEDURES for step-by-step instructions for operation of power supply.

CONNECTIONS FOR OPERATION AS A CONSTANT VOLTAGE SOURCE

The regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on this characteristic, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Two-Wire Connection, Figure 3. The two-wire connection with local sensing, provides simplest connection suitable for applications with relatively constant load.

Four-Wire Connection, Figure 4. The four-wire connection with remote sensing, provides complete compensation for the DC voltage drops in the connecting cables. Compensation for lead drop is also valid for gradual changes of load current.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at 200 ohms/ volt output and a shorting-type switch as shown in figure 5. When continuous voltage variations are required, use a variable resistor with the same 200 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply output voltage can be programmed with an externally connected programming power supply. The output voltage of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply.

The programming supply must have a reverse current capability of 6 ma. minimum.

Alternatively, when supplies with less than 6 ma. reverse current capability are used, a resistor capable of drawing 6 ma. at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

CONNECTIONS FOR OPERATION AS A CONSTANT CURRENT SOURCE

Automatic Crossover Constant Current Connections, Figure 3. Figure 3 shows the connections which are used when operating the power supply as a constant current source with automatic crossover, using local setting of current control.

In this mode of operation, when the load voltage increases, due to changing load resistance, to the limit of the OUTPUT VOLTAGE control setting, the power supply crossover circuit will cause the unit to operate as a constant voltage supply.

CONNECTIONS FOR SERIES OPERATION

The voltage capability of LK power supplies can be extended by series operation of two LK power supplies of equal or unequal voltage ratings. A maximum of 200 volts can be connected between either the +DC or -DC terminal and chassis ground.

The two units are shown connected for series operation in figure 7. Figure 7 shows the series connection diagram which would be suitable for use in all applications.

Diodes CR_A and CR_B, which protect the units against reverse voltage, must be capable of withstanding the maximum rated current.

The series connection permits operation for either constant voltage or constant current with automatic crossover to either mode of operation whenever the respective limiting operating current or voltage is reached. Figure 7 shows connection for either local or remote sensing, when the series combination is operated for constant voltage; figure 7a shows the connection required when the series combination is operated for constant current.

CONNECTIONS FOR PARALLEL OPERATION

The current capability of LK power supplies can be extended by parallel operation of two LK power supplies of equal* voltage capacities. The two units are shown connected for parallel operation in figure 8. One power supply designated the (M) unit controls its own output as well as the output of the second power supply, designated the (S) unit.

Unit (S) operates to regulate its current in a ratio to that of the (M) unit by comparing the current in its internal sampling resistor with that current sampled by the master internal sampling resistor. When power supplies of unequal current capacities are parallel connected the division of current supplied will be approximately equal to the ratio of the current ratings of the supplies.

Parallel connected units can be operated for constant voltage with local sensing as well as for constant current with automatic crossover. When operating for constant voltage, the (M) unit can automatically cross over into constant current operation.

DETAILED OPERATING PROCEDURES

SAFETY NOTICE

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. OBSERVE THE USUAL SAFETY PRECAUTIONS WHEN OPERATING OR SERVICING THE EQUIPMENT TO AVOID SHOCK OR INJURY.

CONSTANT VOLTAGE OPERATION, ADJUSTABLE CURRENT LIMIT

1. Remove AC power input to supply and place ON-OFF circuit breaker in OFF position before connecting load to the supply.

2. Determine load requirements, select wire size from figures 1 and 2 and choose desired type of supply-load connection from figures 3 and 4.

3. Connect supply to load as shown on the selected connection diagram.

NOTE: When shipped from the factory, the supply is ready for use as a constant current source with automatic crossover or as a local-sensing constant voltage source. Jumpers are connected at the factory as shown in figure 3. Take care to remove the appropriate jumpers for load requirements that need different supply-load connections. Refer to the appropriate connection diagram.

*For applications using supplies of unequal voltage ratings, consult factory for details of operation.

4. Turn OUTPUT VOLTAGE control knobs to the desired voltage setting.

5. When current to the load must be limited to an intermediate value within the current rating of the supply, turn the CURENT LIMITER control knobs to the desired curent limit setting. If no intermediate current limit is required, turn the control knobs CW to the position for full current rating for the maximum ambient temperature of operation. Refer to section on specifications.

6. Apply AC power to supply.

7. Place ON-OFF circuit breaker in ON position and check that red indicator is lit.

8. Check that output current and output voltage meters indicate desired values; as required, adjust OUTPUT VOLTAGE control knobs and CURRENT LIMITER control knobs to obtain correct meter indications. For non-metered models use externally connected meters and check that correct meter indications exist at output terminals 6 and 4; for remote sensing connections, check at the load terminations of sensing leads on terminals 3 and 7.

9. Power supply is now in proper operation.

PROGRAMMED CONSTANT VOLTAGE OPERATION, ADJUSTABLE CURRENT LIMIT

1. Remove AC power input to the supply and place ON-OFF circuit breaker in OFF position before connecting load to the supply.

2. Determine load requirements, select wire size and length from figures 1 and 2. Choose desired type of supply-load connection from figures 5 or 6. Refer to paragraph on Programmed Voltage Connections.

3. Connect supply to load as shown on the selected connection diagram. As shown in figure 5, take care to use a shorting-type switch for the external programming control when several voltages are desired and the programming voltage method is not used.

4. Turn OUTPUT VOLTAGE control knobs to the extreme CCW position. Adjust external programming voltage control to desired voltage setting.

5. When current to the load must be limited to an intermediate value within the current rating of the supply, turn the CURRENT LIMITER control knobs to the desired current limit setting. If no intermediate current limit is desired, turn the control knobs CW to the position for full rated current for the ambient temperature of operation. Refer to section on specifications.

6. Apply AC power to the supply.

7. Place ON-OFF circuit breaker in ON position and check that red indicator is lit.

8. Check that output current and output voltage meters indicate desired values; as required, adjust CURRENT LIMITER knobs and external programming voltage control to obtain correct meter indications. For non-metered models use externally connected meters and check that correct meter indications exist at output terminals 4 and 6; for remote sensing connections, check at the load terminations of sensing leads on terminal 3 and 4.

9. Power supply is now operating properly.

CONSTANT CURRENT OPERATION WITH CROSSOVER, ADJUSTABLE VOLTAGE LIMIT

1. Remove AC power input to the supply and place ON-OFF circuit breaker in OFF position before connecting load to the supply.

2. Determine load requirements and connect load to the supply as shown in figure 3.

3. Turn the CURRENT LIMITER knobs to the desired current settings.

4. When load voltage must be limited to an intermediate value within the voltage rating of the supply, turn OUTPUT VOLTAGE control knobs to the desired voltage limit setting. If no intermediate voltage limit, within rating of supply is desired, turn control knobs to the full CW position to obtain voltage limit at maximum voltage rating of the supply.

5. Apply AC power to the supply.

6. Place ON-OFF circuit breaker in ON position and check that red indicator is lit.

7. Check that output current and output voltage meters indicate desired values; adjust OUTPUT VOLTAGE control knobs and CURRENT LIMITER control knobs as required to obtain correct indications. For non-metered models use externally connected meters and check that correct meter indications exist at output terminals 4 and 6.

8. Power supply is now in proper operation.

SERIES CONNECTION CONSTANT VOLTAGE OPERATION, WITH CURRENT LIMIT

1. Remove AC power input to the (B) and (A) units and place ON-OFF circuit breakers in OFF position before connecting load to the supplies.

2. Determine load requirements, select wire size from figures 1 and 2 and choose correct type of series supply-load connections from figure 7. Refer to paragraph on Connections for Series Operation.

3. Connect supply to load as shown on the selected connection diagram. As required, select diodes CR_A and CR_B in accordance with instructions contained in Connections for Series Operation.

4. Turn (A) and (B) unit OUTPUT VOLTAGE control knobs to the desired total voltage setting.

5. When current to the load must be limited to an intermediate value within current rating of the units, turn each CURRENT LIMITER control knob to the desired setting. If no intermediate current limit is required, turn the control knobs of each unit CW to the position for full current rating for the maximum ambient temperature of operation. Refer to section on specifications.

> NOTE: When units of unequal current rating are series connected, the unit with the lower current rating must be capable of delivering the desired load current.

6. Apply AC power to the supplies.

7. Place ON-OFF circuit breakers of both units in ON position and check that red indicators are lit.

8. Check that output current and output voltage meters indicate desired values; total voltage is equal to sum of (A) and (B) units. As required, adjust OUTPUT VOLTAGE control knobs of both units to obtain correct indication; overload supply and adjust CURRENT LIMITER control knobs of both units to obtain correct indications. For non-metered models use externally connected meters and check that correct meter indications exist at output terminals of both units; positive (+) terminal of (A) unit and minus (-) terminal of the (B) unit are the output terminals of the series combination.

For remote sensing connection, make checks at the load terminations of sensing leads from terminal 7 of (A) and from terminal 3 connection of (B) unit.

9. Power supplies are now in proper operation.

PARALLEL CONNECTION CONSTANT VOLTAGE OPERATION, WITH CURRENT LIMIT

1. Remove AC power input to each supply and place ON-OFF circuit breaker on both (M) and (S) units in OFF position before connecting load to the supplies.

2. Determine load requirements, select wire size from figures 1 and 3 in the manual. Refer to paragraph on Connections for Parallel Operation.

3. Connect supplies to load as shown in connection diagram, figure 8.

> NOTE: When shipped from the factory, each supply is ready for use as a constant current source or as a local-sensing constant voltage source. Jumpers are connected at the factory. Take care to remove the appropriate jumpers for load requirements that need different supply-load connections. Refer to the appropriate connection diagram.

4. Turn OUTPUT VOLTAGE control knobs on the (M) unit to the desired voltage setting, and turn the OUTPUT VOLTAGE control knobs on the (S) unit to fully CCW position.

5. When current to the load must be limited to an intermediate point, turn the CURRENT LIMITER control knobs on both the (M) and (S) units to the desired current limit setting. Set current limit control on the (M) and (S) units to the position indicating the current value to be delivered by the respective unit. If no intermediate current limit is desired, turn the CURRENT LIMITER control knobs CW on both (M) and (S) units to the position for full rated current for the maximum ambient temperature of operation. Refer to section on specifications.

6. Apply AC power to each supply.

7 Place ON-OFF circuit breakers on (M) and (S) units in ON position and check that red indicators are lit.

8. Check that output current and output voltage meters on both (M) and (S) units indicate desired values; as required, adjust OUTPUT VOLTAGE control and CURRENT LIMITER CONTROL on (M) unit to obtain correct meter indications. For non-metered models use externally connected meters and check that correct meter indications exist at output terminals 4 and 6 of the (M) unit.

9. Power supplies are now in proper operation.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat causes the circuit breaker to open the input circuit only when the temperature of the transistor heat radiator exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the radiator decreases to safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, place ON-OFF circuit breaker in the ON position and resume operation of the supply. Refer to appropriate operation paragraph in DETAILED OPERATING PROCEDURE.

Fuse Shutdown

Internal failure of supply causes the fuse to clear the circuit, removing input power from the supply Overloading of the unit will not cause fuse failure. Fuses will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

MAINTENANCE

GENERAL

This section describes trouble analysis routine, replacement procedures, calibration and test procedures that are useful for servicing the Lambda power supply. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunctions before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumper and supply-load connections or fuse failure due to metal fatigue.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an in-circuit transistor checker. If no checker is available, transistors can be checked with an ohmmeter that has a highly limited current capability. Observe proper polarity for PNP or NPN to avoid error in measurement. The forward transistor resistance is low but never zero; backward resistance is always higher than the forward resistance.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional defective components could damage the replaced component.

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers placed between the component and the solder joint to provide an effective heat sink.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In most cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil intact but not covered with solder it is a good contact. Do not attempt to cover with solder.

2. Voltage measurements can be made from either side of the board. Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to measuring instrument.

3. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.

4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:

(a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

(b) Dip the wick in liquid rosin flux.

(c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

(d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

ADJUSTMENT OF CALIBRATION CONTROLS

Whenever parts are replaced, adjust calibration controls only when voltage and current indications are improper and do not reflect maximum ratings.

Adjust Maximum Output Voltage Set Control R272 as Follows

1. Remove AC power input to the supply and place ON-OFF circuit breaker in OFF position.

2. Unsolder wiper of R272 from resistor housing.

3. Operate the power supply for constant voltage with local-sensing jumpers connected as shown in figure 3, and no external load.

4. Turn OUTPUT VOLTAGE control knobs fully clockwise and, using a DC voltmeter of 0.1 percent accuracy or better, adjust R272 to provide output voltage E_O MAX + 0.20 volts; where E_O MAX is the rated output voltage of the supply.

5. After adjustment is completed, remove AC power input to the supply and solder wiper of R272 to potentiometer housing.

Adjust Maximum Output Current Set Control R255 as Follows:

1. Remove AC power input to the supply and place ON-OFF circuit breaker in OFF position.

2. Unsolder wiper of R255 from resistor housing.

3. Turn OUTPUT VOLTAGE control knobs and CURRENT LIMITER control fully CW.

4. Operate the power supply for constant current crossover, connected as shown in figure 3, with a short circuit across the output terminals.

5. Adjust R255 for 105% of rated current output at 40°C ambient, using any DC ammeter of one percent accuracy or better.

6. After adjustment is completed, remove the power input to the supply and solder wiper of R255 to potentiometer housing.

Adjust Series Regulator Voltage Set Control R152 as Follows:

1. Remove AC power input to the supply and place ON-OFF circuit breaker in OFF position.

2. Unsolder wiper of R152 from resistor housing.

3. Turn OUTPUT VOLTAGE control knobs and CURRENT LIMITER control knobs fully CW.

4. Connect DC voltmeter of one percent accuracy or better, between output terminal 6 and collector at Q302.

5. Connect power supply for constant voltage operation with local sensing jumpers connected as shown in figure 3.

6. **Connect resistive load. Calculate load value as follows:**

$$R_{LOAD} = \frac{E_{MAX}}{I_{MAX}} \text{ at } 40^{\circ}C$$

7. Provide AC input power of 132 VAC to supply and place ON-OFF circuit breaker in ON position.

8. Adjust R152 until voltmeter indicates applicable voltage listed here for the appropriate LK model.

MODEL	VOLTMETER INDICATION
LK350	6.7 VDC
LK351	8.2 VDC
LK352	12.0 VDC

PERFORMANCE CHECKS

Checks With Constant Voltage Operation

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 9. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC VTVM (John Fluke Model 801H or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power supply line regulation accuracy on the VTVM differential meter.

Use a VTVM, Ballantine 320 or equivalent, to measure rms ripple voltage of the power supply DC output.

Checks With Constant Current Operation

Check the regulation of the power supply using the test connection diagram shown in figure 10. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Check the power supply load regulation accuracy while switching from the short circuit to load condition. Measure the voltage across sensing resistor Rs. Use John Fluke Model 801H or equivalent for the VTVM connected across Rs. For Rs, use a resistor having value $Rs = \frac{1}{Iout}$

To obtain regulation figure, substitute values obtained into regulation formula:

$$\frac{\Delta E}{Rs} = \text{Regulation in milliamperes,}$$

where ΔE is the voltage change in millivolts and Rs is the resistance of the sensing resistor.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power supply line regulation accuracy using VTVM and the regulation formula:

$$\frac{\Delta E}{Rs}$$

SERVICE

When additional instructions are required or repair service is desired, contact the nearest office of the Lambda Electronics Corp. where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.

2. Lambda part number.

3. Description of part together with circuit designation.

4. If part is not an electronic part, or is not listed, provide a description, function, and location of the part.

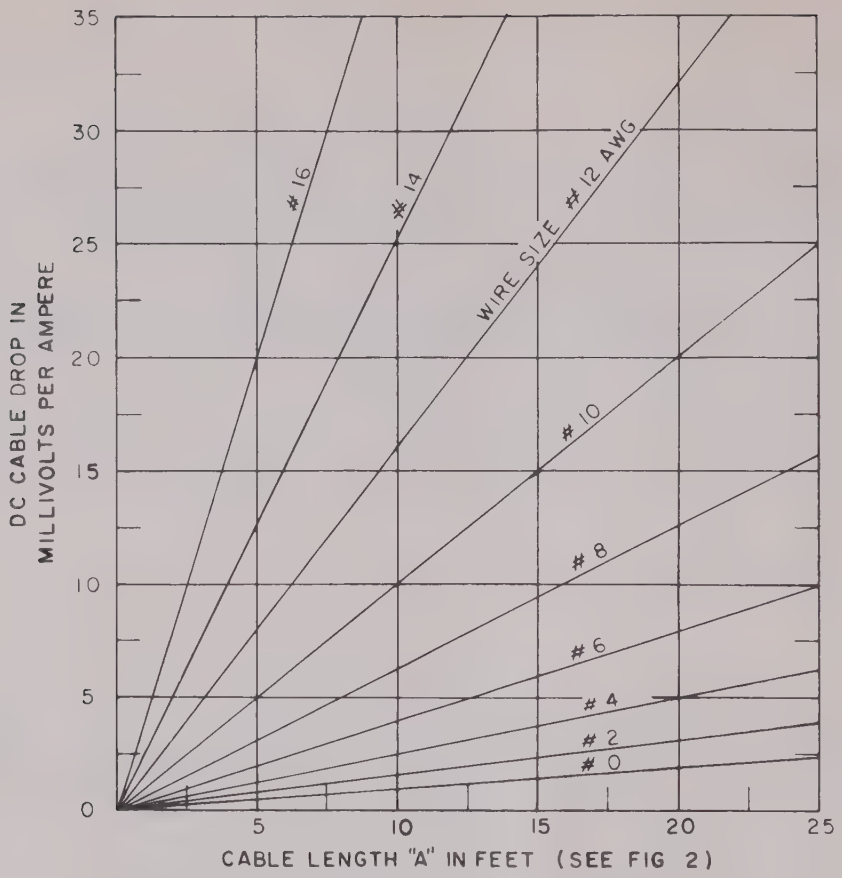


Figure 1. Cable Connection Chart

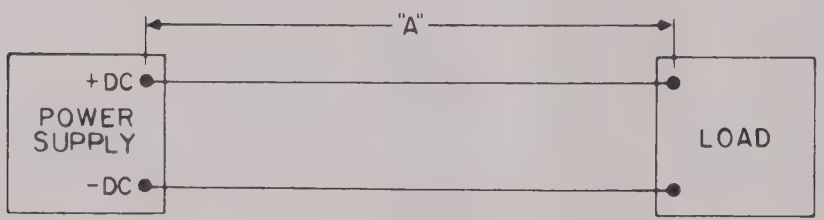
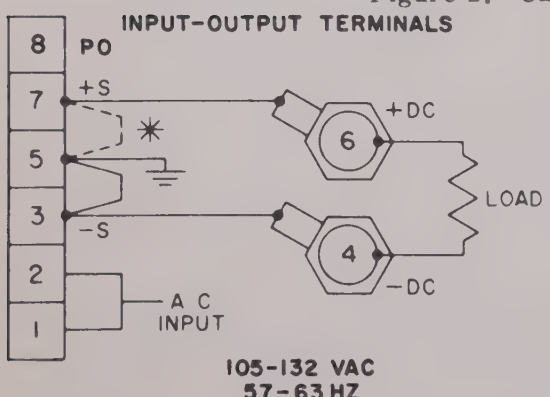


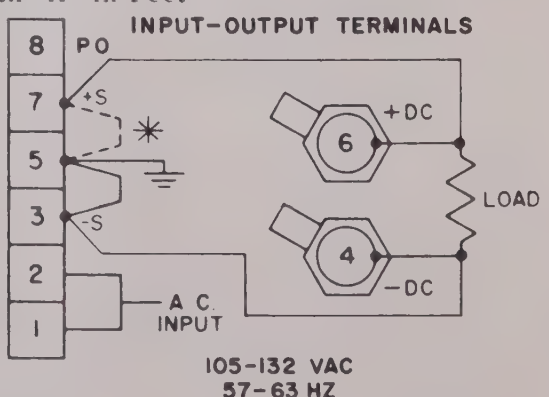
Figure 2. Cable Length "A" in Feet



NOTE:

✳ FOR POSITIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7.

Figure 3. Local Sensing Connections



NOTE:

✳ FOR POSITIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7

Figure 4. Remote Sensing Connections

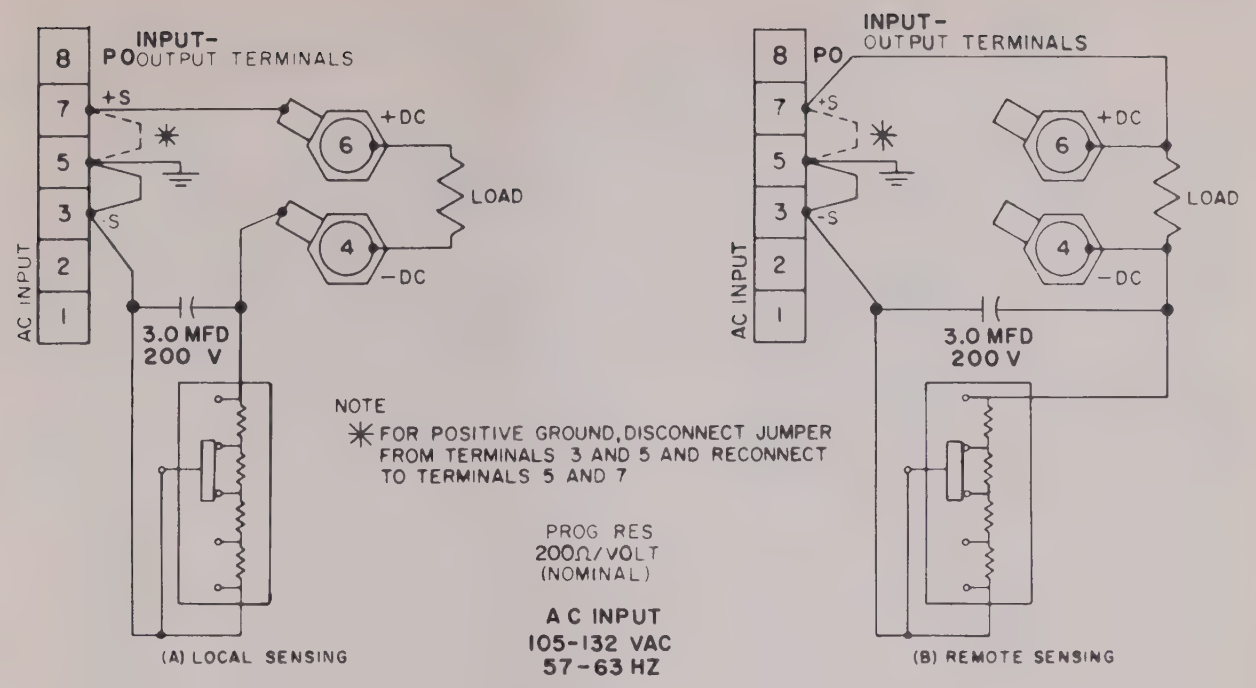


Figure 5. Programmed Voltage With External Resistor

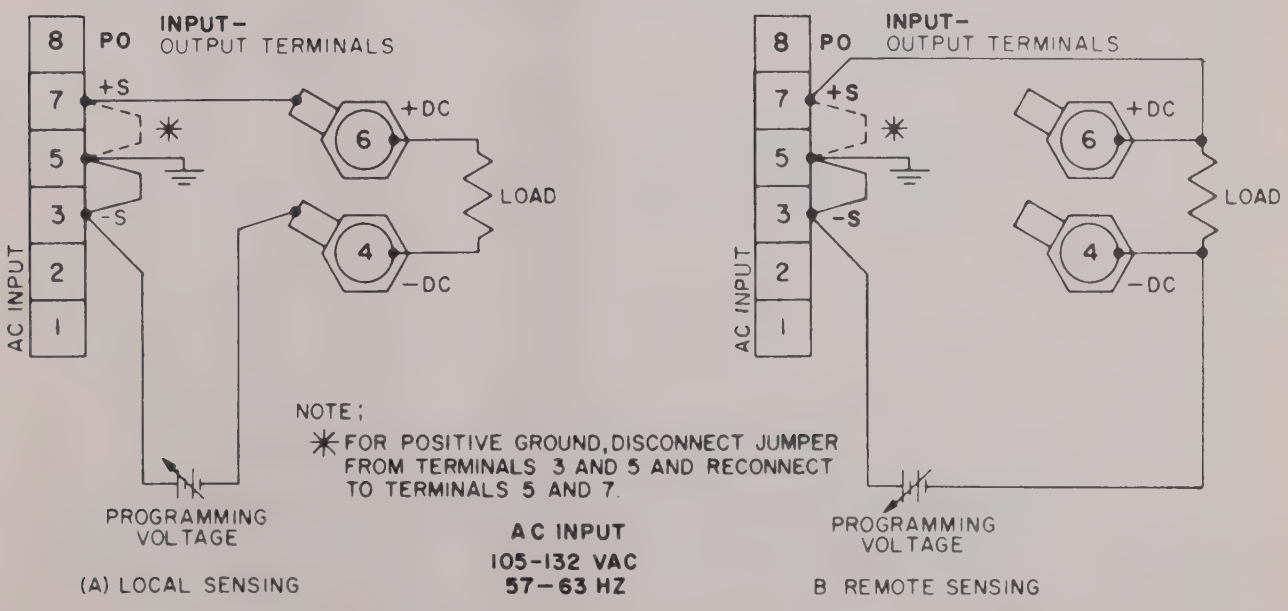
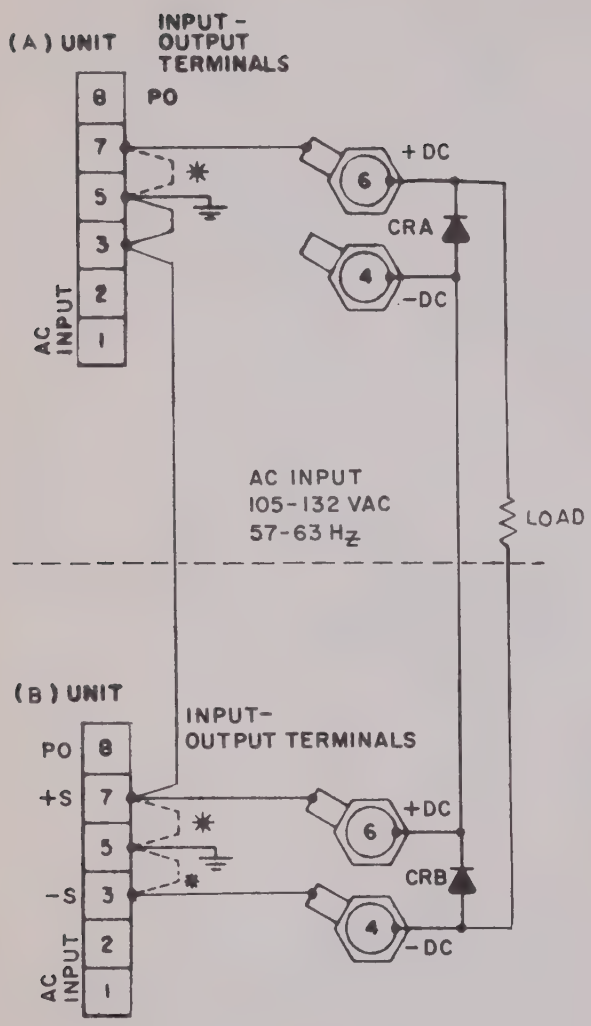
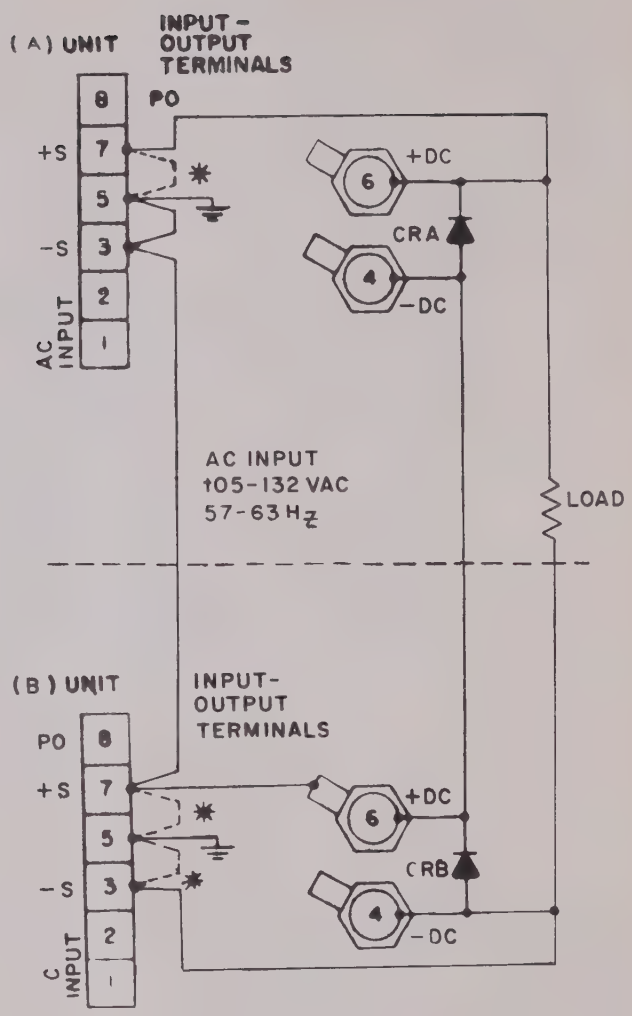


Figure 6. Programmed Voltage With External Programming Voltage Source





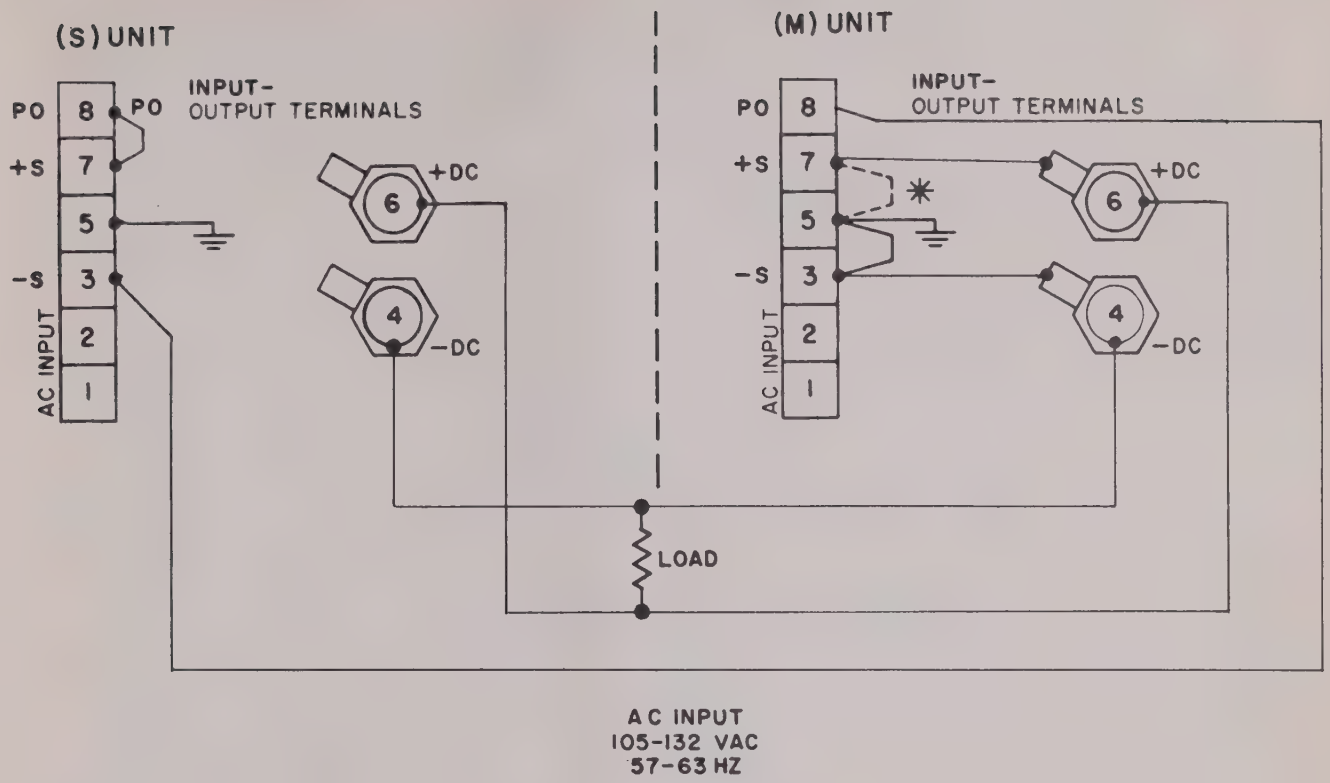
(A) LOCAL SENSING

(B) REMOTE SENSING

NOTE:

* MAKE ONLY ONE GROUND CONNECTION FOR THE SERIES COMBINATION, TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS 5 AND 3 ON (A) UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE.

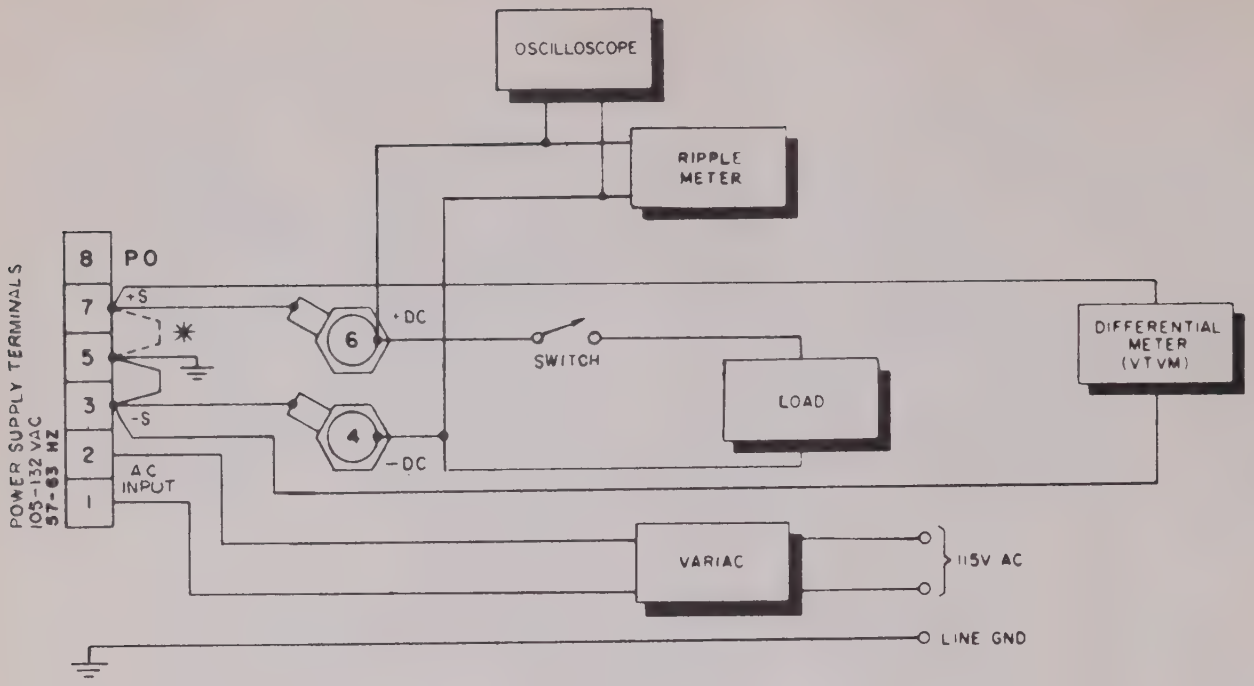
FIGURE 7 SERIES CONNECTION



***CAUTION: VOLTAGE CONTROLS OF (S) UNIT MUST BE SET FOR ZERO VOLTS OUTPUT.

NOTE:
*FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 3 AND RECONNECT TO TERMINALS 7 AND 5.
**FOR IMPROVED CURRENT BALANCING, THE "+DC" LEADS MUST BE THE SAME LENGTH AND SIZE.

FIGURE 8 PARALLEL CONNECTION, LOCAL SENSING

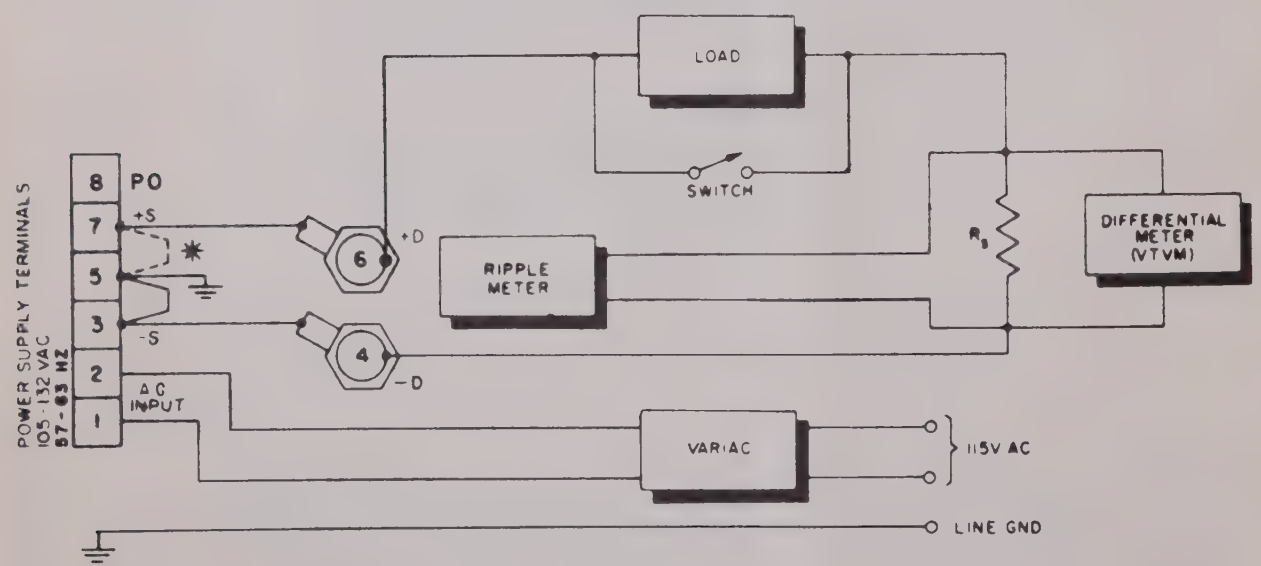


NOTES

1 REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND

2 PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY

FIGURE 9 TEST CONNECTIONS FOR CONSTANT VOLTAGE PERFORMANCE CHECKS



NOTES

1 REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND

2 PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY

FIGURE 10 TEST CONNECTIONS FOR CONSTANT CURRENT PERFORMANCE CHECKS

SCB-350A

NOTES

1 RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE NOTED
2 RESISTOR WATTAGE 1/2 WATT, RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED
3 RESISTOR TOLERANCES: COMPOSITION ±10% WIREWOUND ±5% UNLESS OTHERWISE NOTED
4 CAPACITOR TOLERANCES: ELECTROLYTIC -10% +100%, TANTALUM, ±20%, PAPER, ±10%, CERAMIC, ±20%, MICA, ±20%, MYLAR, ±10%, UNLESS OTHERWISE NOTED
5 SYMBOLS
- INDICATES CLOCKWISE ROTATION OF SHAFT
- INDICATES CONNECTION TO CHASSIS
- INDICATES ADJUSTMENT OR CALIBRATION CONTROL
- INDICATES ACTUAL UNIT MARKING
- [ ] INDICATES FRONT PANEL MOUNTED COMPONENT
- * INDICATES FACTORY ADJUSTMENT, SEE INSTRUCTION MANUAL
- INDICATES TRANSFORMER LUG TERMINAL
- THIS DIODE IS LAMBDA PART NO FBL-00-030, CAN BE REPLACED WITH STANDARD TYPE 1N4002 DIODE UNLESS OTHERWISE NOTED.
6 CONDITIONS FOR CIRCUIT POINT VOLTAGE MEASUREMENTS
A CONSTANT VOLTAGE
READ ITALICIZED NUMBERS FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT VOLTAGE OPERATION
•INPUT 120 VAC, 60 HZ
OUTPUT MAX RATED VOLTAGE, OUTPUT CURRENT ZERO
B CONSTANT CURRENT
READ NUMBERS IN PARENTHESES FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT CURRENT OPERATION
•INPUT 120 VAC, 60 HZ.
OUTPUT 0 VOLTS, OUTPUT CURRENT MAX RATED CURRENT, SHORT CIRCUIT.
INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED
DC MEASUREMENTS TAKEN WITH 20,000 OHMS/VOLT VOLTMETER BETWEEN -DC (TERM 4) AND INDICATED POINTS UNLESS OTHERWISE NOTED
7 DESIGNATIONS ARE LAMBDA PART NUMBERS
8 INDICATES TERMINAL LOCATED ON TERMINAL BOARD "C", OR PRINTED WIRING BOARDS "A", "B"
9 COAT BOTH SIDES OF MICA WASHER OR ANODIZED ALUMINUM WAFER WITH DOW CORNING NO 340 SILICONE GREASE

CAUTION
NOT AT CHASSIS GROUND POTENTIAL
DO NOT SHORT TO CHASSIS GROUND

NOTE 9
MICA INSULATING WASHER
CHASSIS GROUND
COLLECTOR (CASE)
BASE
EMITTER
TRANSISTOR PIN VIEW

DUAL COMPLEMENTARY TRANSISTOR PIN VIEW
Q251, Q252
Q211, Q212

PRE-REGULATOR CONTROL
RAMP C.C. SOURCE
SERIES REGULATOR CONTROL
REFERENCE SOURCE
CURRENT REGULATOR COMPARATOR
VOLTAGE REGULATOR COMPARATOR
CURRENT CONTROL GENERATOR
SERIES REGULATOR
PRE-REGULATOR
6 TRANSISTORS Q303 THRU Q308 FBN-36972
3 RESISTORS R313A,B R315A,B R317A,B
6 RESISTORS R312, R314, R316, R318, R320, R322
CONSTANT CURRENT PRE LOAD
OUTPUT VOLTAGE VDC

RATING TABLE

AMBIENT TEMP	MAX LOAD
40°C	0-35 A
50°C	0-31 A
60°C	0-26 A
71°C	0-20 A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS
DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING "2-WIRE CONNECTION"

SCHEMATIC DIAGRAM REGULATED POWER SUPPLY 0-20 VOLTS
MODEL LK 350

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO PREFIX A

LAMBDA
ELECTRONICS CORP
MELVILLE, L. I., NEW YORK
Veeco

SCB 351A

NOTES

1. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE NOTED
2. RESISTOR WATTAGE 1/2 WATT, RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED
3. RESISTOR TOLERANCES: COMPOSITION ±10%, WIREWOUND ±5% UNLESS OTHERWISE NOTED
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10% +100%, TANTALUM, ±20%, PAPER, ±10%, CERAMIC, ±20%, MICA, ±20%, MYLAR, ±10%, UNLESS OTHERWISE NOTED
5. SYMBOLS
   - INDICATES CLOCKWISE ROTATION OF SHAFT
   - INDICATES CONNECTION TO CHASSIS
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL
   - INDICATES ACTUAL UNIT MARKING
   - INDICATES FRONT-PANEL MOUNTED COMPONENT
   - * INDICATES FACTORY ADJUSTMENT, SEE INSTRUCTION MANUAL
   - INDICATES TRANSFORMER LUG TERMINAL
   - THIS DIODE IS LAMBDA PART NO FBL-00-030, CAN BE REPLACED WITH STANDARD TYPE IN4002 DIODE UNLESS OTHERWISE NOTED
6. CONDITIONS FOR CIRCUIT POINT VOLTAGE MEASUREMENTS
   - A CONSTANT VOLTAGE
     - READ ITALICIZED NUMBERS FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT VOLTAGE OPERATION
     - INPUT 120 VAC, 60 HZ
     - OUTPUT MAX RATED VOLTAGE, OUTPUT CURRENT ZERO
   - B CONSTANT CURRENT
     - READ NUMBERS IN PARENTHESES FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT CURRENT OPERATION
     - INPUT 120 VAC, 60 HZ,
     - OUTPUT 0 VOLTS, OUTPUT CURRENT MAX RATED CURRENT (SHORT CIRCUIT)
   - INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED
   - DC MEASUREMENTS TAKEN WITH 20000 OHMS/VOLT VOLTMETER BETWEEN -DC (TERM 4) AND INDICATED POINTS UNLESS OTHERWISE NOTED
7. DESIGNATIONS ARE LAMBDA PART NUMBERS
8. INDICATES TERMINAL LOCATED ON TERMINAL BOARD "C", OR PRINTED WIRING BOARDS "A", "B"
9. COAT BOTH SIDES OF MICA WASHER OR ANODIZED ALUMINIUM WAFER WITH DOW CORNING NO 340 SILICONE GREASE.

CAUTION
NOT AT CHASSIS GROUND POTENTIAL
DO NOT SHORT TO CHASSIS GROUND

NOTE 9
MICA INSULATING WASHER
CHASSIS GROUND

COLLECTOR (CASE) BASE EMITTER
TRANSISTOR PIN VIEW

DUAL COMPLEMENTARY TRANSISTOR PIN VIEW
Q251, Q252
Q211, Q212

PRE-REGULATOR CONTROL
RAMP C.C. SOURCE
REFERENCE SOURCE
SERIES REGULATOR CONTROL
CURRENT CONTROL GENERATOR
CURRENT REGULATOR COMPARATOR
VOLTAGE REGULATOR COMPARATOR
AMPLIFIER
OUTPUT REFERENCE
SCR GATE TRIGGER
COMPARATOR
SERIES REGULATOR VOLTAGE SET
CURRENT LIMITER IDC
MAX OUTPUT CURRENT SET
MAX OUTPUT VOLTAGE SET
SERIES REGULATOR
CONSTANT CURRENT PRE LOAD
PRE-REGULATOR
COIL FOR S1
OUTPUT VOLTAGE VDC

6 TRANSISTORS Q303 THRU Q308 FBN-38022
3 RESISTORS R313A,B R315A,B R317A,B 0.3,11W/SECTION WW
6 RESISTORS R312, R314, R316, R318, R320, R322 3.3,5%

RATING TABLE

AMBIENT TEMP	MAX LOAD
40°C	0-25A
50°C	0-23A
60°C	0-20A
71°C	0-5A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS
DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING 2-WIRE CONNECTION

TB1 REAR OUTPUT TERMINALS
PO
+S
+V
-V
-S
WHT
BLK

SCHEMATIC DIAGRAM REGULATED POWER SUPPLY 0-36 VOLTS
MODEL LK351

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

LAMBDA
ELECTRONICS CORP
MELVILLE, L.I., NEW YORK
A VOLTRON SUBSIDIARY

SCB 352A

NOTES

1. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE NOTED
2. RESISTOR WATTAGE 1/2 WATT, RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED
3. RESISTOR TOLERANCES: COMPOSITION ±10%, WIREWOUND ±5% UNLESS OTHERWISE NOTED
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10% +100%, TANTALUM ±20%, PAPER, ±10%, CERAMIC, ±20%, MICA ±20%, MYLAR, ±10%, UNLESS OTHERWISE NOTED
5. SYMBOLS
   - INDICATES CLOCKWISE ROTATION OF SHAFT
   - INDICATES CONNECTION TO CHASSIS
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL
   - INDICATES ACTUAL UNIT MARKING
   - [ ] INDICATES FRONT-PANEL MOUNTED COMPONENT
   - * INDICATES FACTORY ADJUSTMENT, SEE INSTRUCTION MANUAL
   - INDICATES TRANSFORMER LUG TERMINAL
   - THIS DIODE IS LAMBDA PART NO FBL-00-030, CAN BE REPLACED WITH STANDARD TYPE IN4002 DIODE UNLESS OTHERWISE NOTED
6. CONDITIONS FOR CIRCUIT POINT VOLTAGE MEASUREMENTS
   - A CONSTANT VOLTAGE
     - READ ITALICIZED NUMBERS FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT VOLTAGE OPERATION
     - INPUT 120 VAC, 60 HZ
     - OUTPUT MAX RATED VOLTAGE, OUTPUT CURRENT ZERO
   - B CONSTANT CURRENT
     - READ NUMBERS IN PARENTHESES FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT CURRENT OPERATION
     - INPUT 120 VAC, 60 HZ
     - OUTPUT 0 VOLTS, OUTPUT CURRENT MAX RATED CURRENT-SHORT CIRCUIT
   - INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED
   - DC MEASUREMENTS TAKEN WITH 20,000 OHMS/VOLT VOLTMETER BETWEEN -DC (TERM 4) AND INDICATED POINTS UNLESS OTHERWISE NOTED
7. DESIGNATIONS ARE LAMBDA PART NUMBERS
8. ◯ INDICATES TERMINAL LOCATED ON TERMINAL BOARD "C", OR PRINTED WIRING BOARDS "A", "B"
9. COAT BOTH SIDES OF MICA WASHER OR ANODIZED ALUMINUM WAFER WITH LOW CORNING NO 340 SILICONE GREASE

CAUTION
NOT AT CHASSIS GROUND POTENTIAL
DO NOT SHORT TO CHASSIS GROUND

NOTE 9
MICA INSULATING WASHER
CHASSIS GROUND
COLLECTOR (CASE)
BASE
EMITTER
TRANSISTOR PIN VIEW

DUAL COMPLEMENTARY TRANSISTOR
PIN 1 ⊕ 6
Q251, Q252
Q211, Q212

PRE-REGULATOR CONTROL
RAMP CC SOURCE
FBN-L110 Q131
RAMP GATE
FBN-L118 Q132
SCR GATE TRIGGER
FBN-L108 Q171
COMPARATOR
FBN-L118 Q151
REFERENCE SOURCE
CURRENT CONTROL GENERATOR
FBM-Z104 CR274
FBN-L09 Q271
FBM-Z15 CR273
FBN-L18 Q253
CURRENT REGULATOR COMPARATOR
FBM-Z104 CR232
FBN-L117 Q251, Q252
AMPLIFIER
FBN-L117 Q231
VOLTAGE REGULATOR COMPARATOR
FBN-L117 Q211, Q212
OUTPUT REFERENCE
FBM-Z107 CR271
Q232 FBN-L13 1ST DRIVER
SERIES REGULATOR CONTROL
SERIES REGULATOR VOLTAGE SET
CURRENT LIMITER 10C
SERIES REGULATOR
2ND DRIVER
FBN-36485 Q302
FBN-36487 Q303
6 TRANSISTORS Q303 THRU Q308 FBN-36487
FBN-36487 Q308
3 RESISTORS R313A,B R315A,B R317A,B
6 RESISTORS R312, R314, R316, R318, R320, R322
CONSTANT CURRENT PRE LOAD
FBN-L09 Q301
FBM-Z116 CR302
PRE-REGULATOR
SCR301 FBP-00-013
COIL FOR S1
C305 THRU C309
4000μf 100V
FBL-00-057 (4)
FBL-00-054
FBL-00-055 CR301
M1 0-60V
M2 0-20A
OUTPUT VOLTAGE VDC
TB1 REAR OUTPUT TERMINALS
PO
+S
+V
S
WHT
BLK

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING "2-WIRE CONNECTION"

RAT NG TABLE

AMBIENT TEMP	MAX LOAD
40°C	0-15A
50°C	0-14A
60°C	0-12.5A
71°C	0-10A

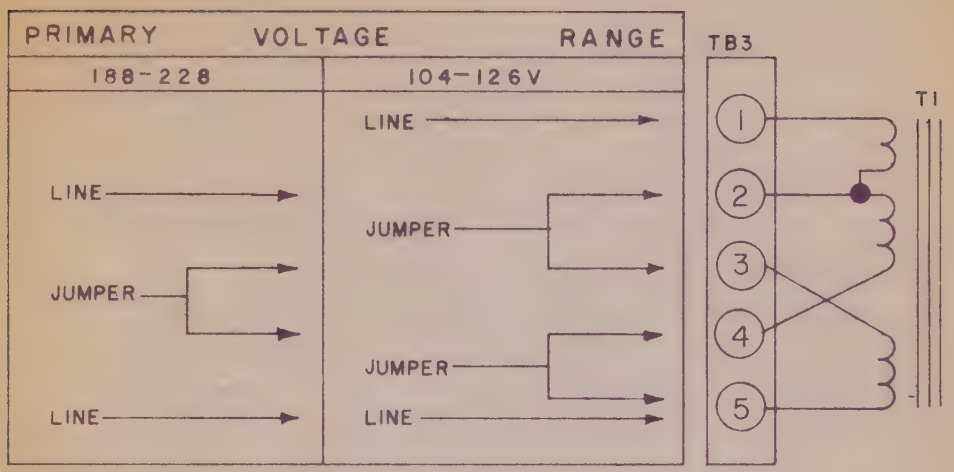
SCHEMATIC DIAGRAM REGULATED POWER SUPPLY 0-60 VOLTS

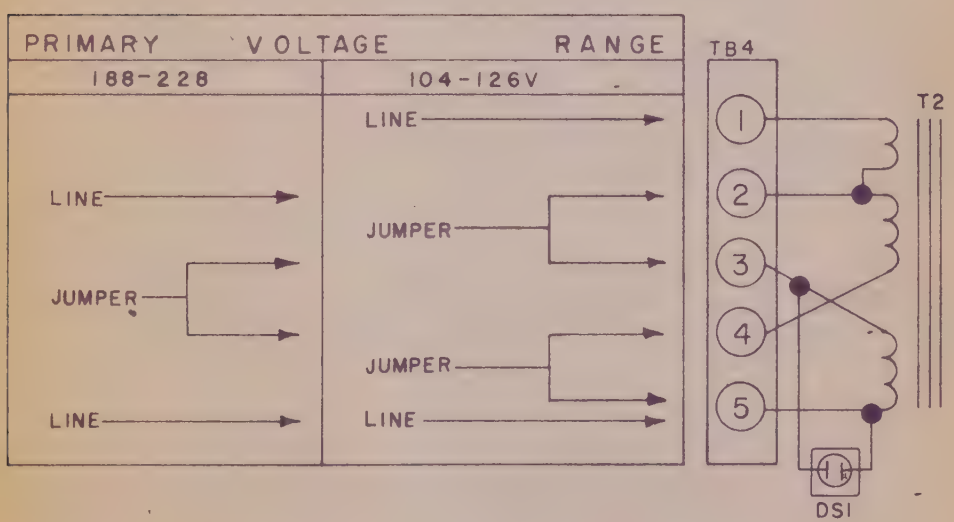
MODEL LK352

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

LAMBDA
ELECTRONICS CORP
MELVILLE, L.I., NEW YORK
A Vesco SUBSIDIARY

LK351-2536-2A-0V



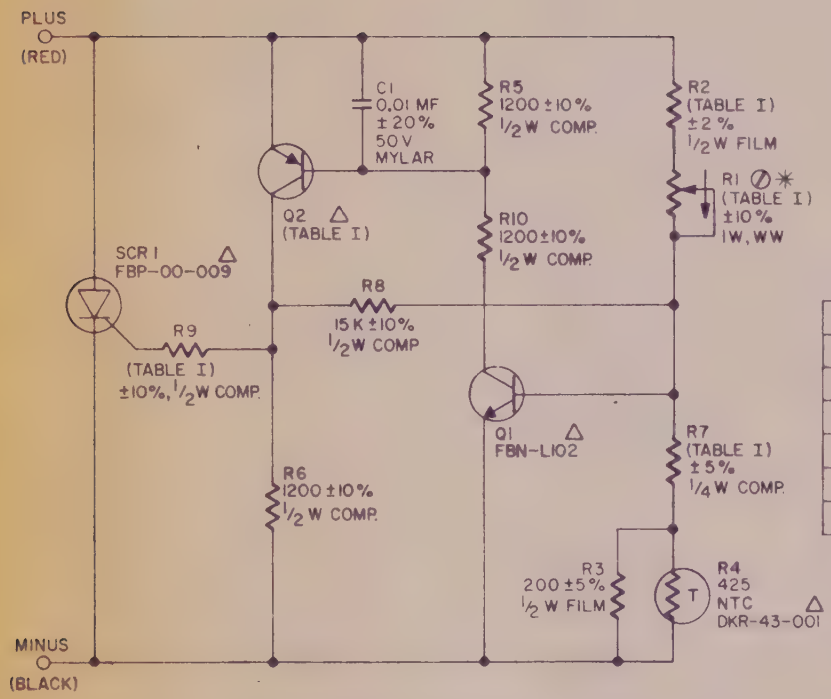


NOTES

1- PRIMARIES OF TWO TRANSFORMERS (T1 & T2) MUST BE CONNECTED IN PARALLEL.

2- BARRIER STRIPS (TB-3 & TB-4) MUST BOTH BE WIRED FOR THE SAME INPUT VOLTAGE.

3- PILOT LIGHT DS1 MUST ALWAYS BE WIRED ACROSS 115 VAC WINDING ON T2.



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. SYMBOLS:
   - ♦ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ⊘ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - ✳ SEE INSTRUCTION MANUAL.
   - △ LAMBDA PART NUMBER.

TABLE I			
	LMOV-1	LMOV-2	LMOV-3
R1	2K	5K	20K
R2	560 *	*1470	4700
R7	33	33	39
R9	JUMPER	JUMPER	22
Q2	FBN-L103	FBN-L103	FBN-L114

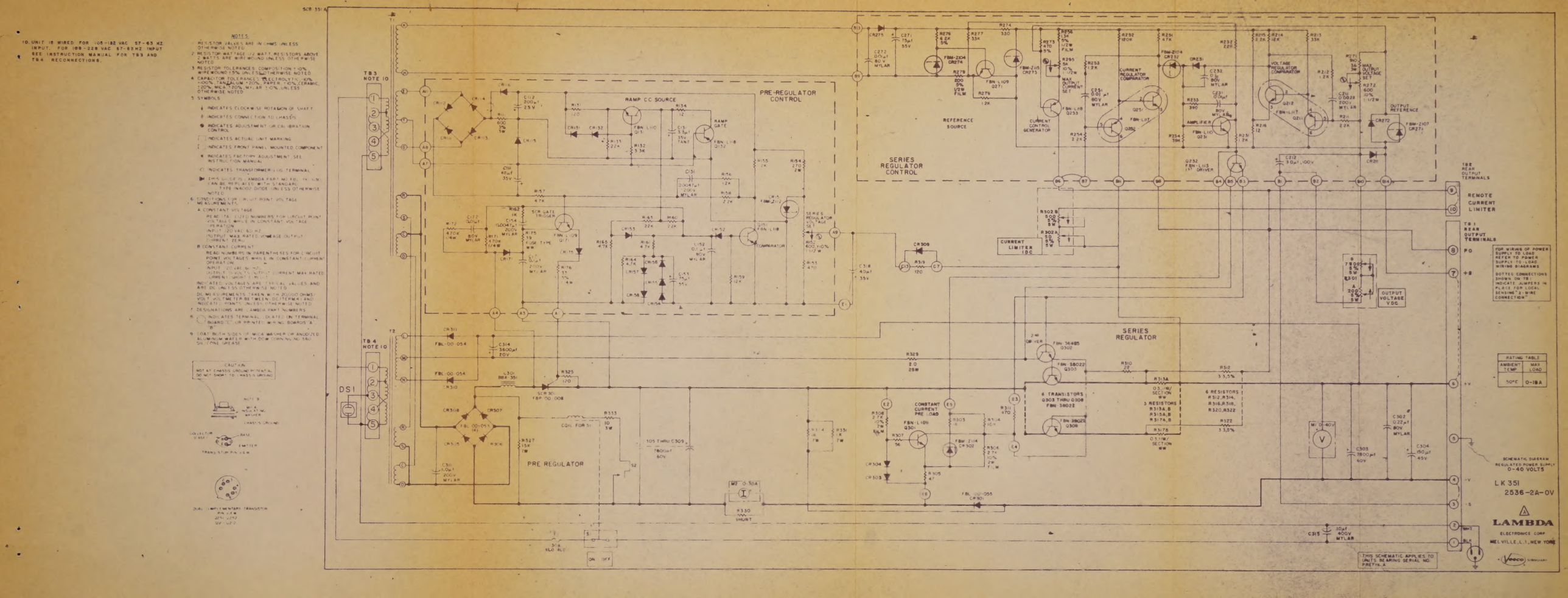
SCHEMATIC DIAGRAM

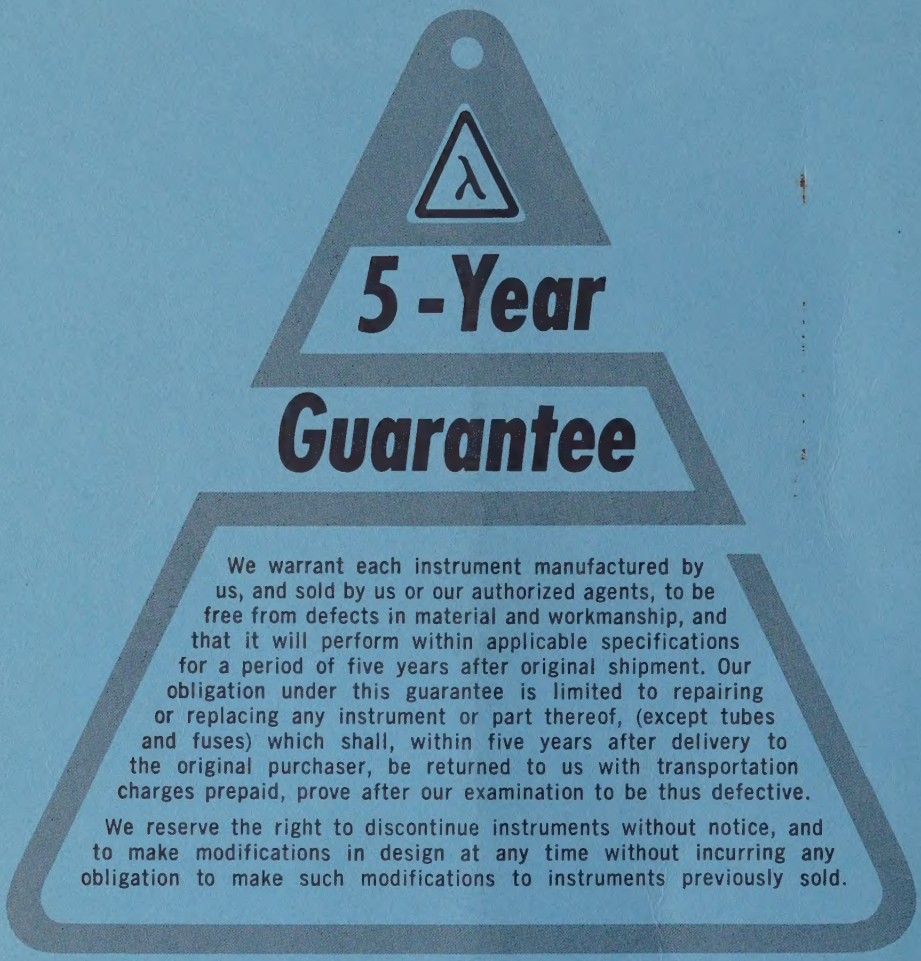
OVERVOLTAGE PROTECTORS
LMOV-1, LMOV-2 & LMOV-3

*R2 ON LMOV-1 WAS 750 OHMS, R2 ON LMOV-2 WAS 1300 OHMS

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

LAMBDA
ELECTRONICS CORP.
MELVILLE NEW YORK


SCR 351A
NOTES
1. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE NOTED
2. RESISTOR WATTAGE 1/2 WATT, RESISTORS ABOVE 2 WATTS ARE WIRE WOUND UNLESS OTHERWISE NOTED
3. RESISTOR TOLERANCES: COMPOSITION ±10%, WIRE WOUND ±5% UNLESS OTHERWISE NOTED
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10% +100% TANTALUM ±20%, PAPER ±10% CERAMIC ±20% MICA ±2% MYLAR ±10% UNLESS OTHERWISE NOTED
5. SYMBOLS
INDICATES CLOCKWISE ROTATION OF SHAFT
INDICATES CONNECTION TO CHASSIS
INDICATES ADJUSTMENT OR CALIBRATION CONTROL
INDICATES ACTUAL UNIT MARKING
INDICATES FRONT PANEL MOUNTED COMPONENT
INDICATES FACTORY ADJUSTMENT, SEE INSTRUCTION MANUAL
INDICATES TRANSFORMER LUG TERMINAL
EMS SILICON AMBOX PART NO. REF. IN CIR. CAN BE REPLACED WITH STANDARD TYPE IN4002 DIODE UNLESS OTHERWISE NOTED
6. CONDITIONS FOR CIRCUIT POINT VOLTAGE MEASUREMENTS
A CONSTANT VOLTAGE
READ TABULATED NUMBERS FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT VOLTAGE OPERATION
INPUT: 220 VAC 50 HZ
OUTPUT: MAX RATED VOLTAGE OUTPUT CURRENT ZERO
B CONSTANT CURRENT
READ NUMBERS IN PARENTHESES FOR CIRCUIT POINT VOLTAGES WHILE IN CONSTANT CURRENT OPERATION
INPUT: 220 VAC 50 HZ
OUTPUT: 0 VOLTS, OUTPUT CURRENT MAX RATED CURRENT SHORT CIRCUIT
INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED
DC MEASUREMENTS TAKEN WITH 20,000 OHMS/VOLT VOLTMETER BETWEEN DESIGNATED AND INDICATED POINTS UNLESS OTHERWISE NOTED
7. DESIGNATIONS ARE AMBOX PART NUMBERS
8. INDICATES TERMINAL (X-ATED) ON TERMINAL BOARD OR PRINTED WIRING BOARDS A, B
9. COAT BOTH SIDES OF MICA WASHER (OR ANODIZED ALUMINUM WASHER WITH OTHER INSULATING TAB) WITH SILICONE GREASE
10. UNIT IS WIRED FOR 105-132 VAC 57-63 HZ INPUT. FOR 189-228 VAC 47-63 HZ INPUT SEE INSTRUCTION MANUAL FOR TB3 AND TB4 RECONNECTIONS.
CAUTION
NOT AT CHASSIS GROUND POTENTIAL
DO NOT SHORT TO CHASSIS GROUND
NOTE 9
MICA INSULATING WASHER
CHASSIS GROUND
COLLECTOR (CASE)
BASE
EMITTER
TRANSISTOR PIN VIEW
DUAL COMPLEMENTARY TRANSISTOR PN-1164 2N-1672 Q2-Q3
TB3 NOTE 10
TB4 NOTE 10
DS1
T1
T2
RAMP CC SOURCE
PRE-REGULATOR CONTROL
SERIES REGULATOR CONTROL
REFERENCE SOURCE
CURRENT CONTROL GENERATOR
CURRENT REGULATOR COMPARATOR
VOLTAGE REGULATOR COMPARATOR
OUTPUT REFERENCE
SERIES REGULATOR
PRE REGULATOR
CURRENT LIMITER IDC
OUTPUT VOLTAGE VDC
CONSTANT CURRENT PRE LOAD
6 TRANSISTORS Q303 THRU Q308 FBN 38022
6 RESISTORS R312, R314, R316, R318, R320, R322
3 RESISTORS R313A, R313B, R317A, B
TB2 REAR OUTPUT TERMINALS
REMOTE CURRENT LIMITER
TB1 REAR OUTPUT TERMINALS
FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY TO LOAD WIRING DIAGRAMS
DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING 2-WIRE CONNECTION
RATING TABLE
AMBIENT TEMP | MAX LOAD
50°C | 0-18A
SCHEMATIC DIAGRAM REGULATED POWER SUPPLY 0-40 VOLTS
LK 351
2536-2A-0V
LAMBDA
ELECTRONICS CORP
MELVILLE, L.I., NEW YORK
THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A


5-Year
Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

LAMBDA ELECTRONICS CORP.
515 BROAD HOLLOW ROAD • MELVILLE, L. I., NEW YORK • 516 MYRTLE 4-4200

A Veeco SUBSIDIARY

MP MASTER
MA28704
92021